

JAPANESE

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CLAIMS DETAILED DESCRIPTION TECHNICAL FIELD PRIOR ART EFFECT OF THE INVENTION
TECHNICAL PROBLEM MEANS DESCRIPTION OF DRAWINGS DRAWINGS

[Translation done.]

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CLAIMS

[Claim(s)]

[Claim 1] A manufacture method of a solar battery characterized by carrying out solder coating on the surface of a solar battery in the end of silver dust after pretreating by flux which applies and calcinates a paste which consists of a metal halogenide, glass powder, an organic binder, and an organic solvent, forms a silver electrode, and does not contain a halogenide.

[Claim 2] A manufacture method of a solar battery according to claim 1 that a metal halogenide is an iridium chloride.

[Claim 3] A manufacture method of a solar battery according to claim 2 which an iridium chloride contains 0.001 to 0.1% of the weight during a paste.

[Claim 4] A manufacture method of a solar battery any one publication of claim 1-3 that a paste contains phosphorus oxide further.

[Claim 5] A manufacture method of a solar battery any one publication of claim 1-4 which the end of silver dust contains 70 to 85% of the weight during a paste.

[Claim 6] Flux characterized by consisting of a stabilizer of said resin as resin, an organic solvent, and an arbitration component, and not including substantially an activator for washing-izing of a silver electrode surface.

[Claim 7] Flux according to claim 6 which resin is polyalkylene glycol system resin, and an organic solvent is isopropyl alcohol, and is the compound with which a stabilizer of resin contains an amino group.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] This invention relates to the flux used for the manufacture method of a solar battery of performing solder coating to a baking silver paste electrode especially, and pretreatment of the solder coating about the flux used for the manufacture method of a solar battery, and it.

[0002]

[Description of the Prior Art] Conventionally, when the solar battery which performs solder coating is crystal silicon, the antireflection film for reducing a surface reflection factor is formed on an N type diffusion layer and on it after etching a P type silicon substrate at the one side used as a light-receiving side. With screen printing, aluminum paste is mostly printed on the whole surface, is calcinated in a rear face in an oxidizing atmosphere at an elevated temperature, and a rear-face aluminum electrode is formed in it. Furthermore, with screen printing, a silver paste is printed in the shape of a pattern on the back [a part of] and the antireflection film by the side of a light-receiving side, it calcinates in an oxidizing atmosphere at an elevated temperature, and a silver electrode is formed. This element is immersed for several 10 seconds in ordinary temperature to the flux containing an activator, it is immersed in about 200-degree C solder bath for about 1 minute after warm air desiccation, and solder coating is performed. then, the last after repeating ordinary temperature underwater ultrasonic cleaning several times among warm water -- a pure water rinse -- warm air desiccation was carried out and the solar battery was manufactured.

[0003]

[Problem(s) to be Solved by the Invention] In recent years, it is pressed for the solar battery which was excellent in reliability especially over a long period of time by the necessity of producing by low cost. As a material which threatens the long-term reliability of many elements containing a solar battery, a halogen is mentioned first of all. Also in manufacture of a solar battery, the flux immersion which contains a halogen in the case of solder coating is used abundantly. A halogen is contained as an activator in the state of mineral salt, such as inorganic acids, such as HCl, or NH₄Cl. These activators are bearing the role which all defecates the surface of a coating-ed object, even if a difference is in activity. In addition, activators with the comparatively mild activity force, such as an organic acid like turpentine, may be used for an activator.

[0004] It is indispensable to carry out washing removal completely after solder coating in use of an activator. When washing is inadequate, the corrosion in an electrode section will occur sooner or later like a publication in reference "development and utilization of an electronic technical December, 1989 separate volume and non-washed flux, and the 56th page." Therefore, it was difficult for a washing production process to become complicated, and to have become a cost high factor, and to prevent corrosion completely.

[0005] By an easy washing production process or no easy washing, in order to have manufactured the reliable solar battery, to use the flux which does not contain an activator was desired. However, when solder coating of the solar battery conventional by the flux which deleted the activator component from the conventional flux was carried out, poor solder **** occurred frequently and there was a problem that-izing could not be carried out [element]. This invention sets to one of the main purposes to produce the solar battery which can prevent the corrosion and the poor solder of an electrode by the easy washing production process or no washing in view of the above-mentioned technical problem.

[0006]

[Means for Solving the Problem] Then, if a halogenide is included in a paste material of a silver electrode while repeating research wholeheartedly about flux which does not contain an activator, an artificer of this invention used to result that poor solder **** can be prevented in a header and this invention, even if he uses flux which does not contain a halogenide unexpectedly.

[0007] That is, on the surface of a solar battery, this invention applies and calcinates a paste which consists of a metal halogenide, glass powder, an organic binder, and an organic solvent in the end of silver dust, forms a silver electrode, and after pretreating by flux which does not contain a halogenide, it offers a manufacture method of a solar battery characterized by carrying out solder coating.

[0008]

[Embodiment of the Invention] (1) In this invention, a silver electrode applies and calcinates the paste containing an electrode material, and is made. Here, an electrode material consists of glass powder, an organic binder, and an organic solvent, and that for which any material and gestalten (especially magnitude of a powder etc.) are also usually used in this field can be used for it, and it is not limited especially in the end of silver dust. In addition, specifically, TEREPINE oil and butyl-acetate carbitol can be used for an organic binder and an organic solvent as ethyl cellulose, a nitrocellulose, and the latter as the former.

[0009] An electrode material is further mentioned including a halogenide as what has a chloride desirable as this halogenide like an iridium chloride, and it is more more desirable still that the 5th group element compound like phosphorus oxide is included. As for the blending ratio of coal of various components, it is desirable that they are glass powder:3.0–3.5 % of the weight, organic binder:9.0–10.0 % of the weight, organic solvent:13.5–14.5 % of the weight, and iridium chloride:0.001–0.1 % of the weight to 100 % of the weight in the end of silver dust. The paste of these electrode materials serves as a silver electrode by spreading and 550–800-degree C baking which are usually performed in this field. In addition, it is desirable to add an about 150-degree C desiccation production process before this baking.

[0010] In this invention, the thing which were explained by the term of a Prior art in which flux has the detergency of a silver electrode surface by itself "excluding a halogenide" about flux and which it solves and is not included for the halogenide as an activator is meant.

[0011] for example, as flux in this invention The thing excluding the halogenide as an activator from the flux used in this field can be used. Usually, specifically What becomes the resin, the solvent, and arbitration for giving the concordance nature of the solder of a silver electrode surface from the stabilizer of resin can be mentioned. Preferably The compound which contains polyalkylene glycol system resin (average molecular weight: 200–800 are desirable) as resin, and contains the amino group as a stabilizer of isopropyl alcohol and resin as an organic solvent can be illustrated, respectively. As for the blending ratio of coal of these various components, it is desirable that they are organic solvent:95–105 % of the weight and stabilizer:0.2–0.3% of the weight of resin to 100 % of the weight of resin.

[0012] This invention is the flux beforehand used in case solder coating is carried out at the silver electrode formed on the surface of the solar battery according to another viewpoint, applies and calcinates the paste which consists of a metal halogenide, glass powder, an organic binder, and an organic solvent on the surface of a solar battery in the end of silver dust, forms a silver electrode, and after pretreating by the flux which does not contain the halogenide as an activator, it offers the flux characterized by to carry out solder coating.

[0013] The antireflection film which was formed in the light-receiving side side of a silicon substrate and this substrate according to viewpoint that this invention is still more nearly another, The aluminum electrode formed in the rear face of a substrate, and the silver electrode formed in this aluminum electrode and antireflection film, respectively, It consists of a solder film by which coating was carried out to these silver electrodes, and the solar battery characterized by for said silver electrode having applied and calcinated the paste with which it consists of a metal halogenide, glass powder, an organic binder, and an organic solvent in the end of silver dust, and making it is offered.

[0014] (2) Here, explain the basic configuration of a solar battery which the manufacture method of the solar battery concerning this invention makes applicable to manufacture. The schematic diagram and drawing 2 which show the basic structure of a solar battery where drawing 1 performs solder coating are a flow chart which shows the main manufacture processes of a solar battery.

[0015] Are typical as a solar battery with which a solar battery S adopts crystal silicon in drawing 1. The P type silicon substrate 1 and the antireflection film 3 formed in order to reduce a surface reflection factor to the light-receiving side side of this substrate, It mainly consists of the aluminum electrode 4 formed in the rear face of a substrate 1, this aluminum electrode and the silver electrode 5–6 formed in the antireflection film 3, respectively, and a solder film 7–8 by which coating was carried out to these silver electrodes. In addition, the solder film 7–8 is for soldering a lead (illustration abbreviation).

[0016] Next, the manufacture method of the solar battery S which consists of the above configuration is explained. In drawing 1 and 2, an antireflection film 3 is formed the N type diffusion layer 2 and on it after etching the P type silicon substrate 1 at the one side side used as a light-receiving side. With screen printing, aluminum paste is mostly printed on the whole surface, is calcinated in a rear face in an oxidizing atmosphere at an elevated temperature, and the rear-face aluminum electrode 4 is formed in it.

Furthermore, with screen printing, a silver paste is printed in the shape of a pattern to on the back [a part of] and the antireflection film 3 by the side of a light-receiving side, it calcinates in an oxidizing atmosphere at an elevated temperature, and the silver electrode 5–6 is formed. This element is immersed in about 200-degree C solder bath for about 1 minute after immersion and warm air desiccation for several 10 seconds in ordinary temperature to flux, and solder coating is performed. then, the last after repeating ordinary temperature underwater ultrasonic cleaning several times -- a pure water rinse -- warm air desiccation is carried out and a solar battery S is obtained.

[0017] Conventionally, the role of the flux in solder coating of a solar battery is that the polar zone finishing / baking] is immersed in flux, and when resin covers the silver surface till the moment the silver surface where the activator in flux defecated the baking silver surface, and was subsequently defecated contacts solder, it is supposed that it is it what is protected from new contamination.

[0018] On the other hand, solder coating is carried out and it is considered to become that the surface of that easy has many rates of the silver by the side of the solder contact surface of the silver electrode obtained by baking of a silver paste compared with other components, such as glass, and its silver is strange under the effect of an additive, and an important factor that reforming is not carried out.

[0019] In the silver paste adopted by this invention, by calcinating in an elevated temperature and an oxidizing atmosphere, fire through [of the antireflection films, such as a silicon nitride and a titanium oxide film,] (penetration) is carried out, and it has the feature of taking electric contact in the N type silicon layer directly under a film.

[0020] Drawing 3 is a conceptual diagram about the component action before and behind baking of a silver paste, (a) shows baking before and (b) shows the baking back, respectively. In drawing 3 (a), an antireflection

film 3 is formed in the light-receiving side side of a P type silicon substrate through the N type diffusion layer 2, and printing formation of the silver paste 10 is carried out at the shape of a pattern at this antireflection film 3. 12 shows the silver component of the silver paste 10, and 13 shows a glass component, respectively.

[0021] And if this silver paste 10 is calcinated in an oxidizing atmosphere at an elevated temperature, since the presentation of the glass component 13 by the side of the contact surface with solder will become less than usual, that is, it will become silver Rich's presentation by localizing to about three antireflection film since it is consumed, although most glass components 13 under silver paste 10 fuse an antireflection film 3 like drawing 3 (b) at the time of this baking, it is in the condition which solder coating is easy to be carried out. Therefore, in this system, if even the resin which can cover the silver surface completely has resin till the moment the silver surface contacts solder, even if it does not use an activator, it will be thought that solder coating becomes possible.

[0022] (3) Explain the example of this invention hereafter.

[Example 1] The N type diffusion layer 2 which has the field resistance of about 50ohms / ** in the single-sided surface of the P type silicon substrate 1 of 125mm square shape by the 900-degree C thermal diffusion of P was formed, and about 60nm silicon nitride was formed by the plasma-CVD method as an antireflection film 3 on it by 330 microns in thickness by which texture etching was carried out. The commercial aluminum paste was printed at the rear face with screen printing, it calcinated at it at 700 degrees C after desiccation and among air by about 150 degrees C, and the reverse side aluminum electrode 4 was formed in it.

[0023] Next, similarly the silver paste 6 which consists of a presentation of a table 1 was printed to the position on the back with screen printing at about 30-micron thickness, and it dried at 150 degrees C for about 4 minutes. In addition, the organic vehicles (excipient) and organic solvents as an organic binder are specifically a nitrocellulose and butyl-acetate carbitol in a table 1.

[0024]

[A table 1]

成 分	比率 (wt%)
銀粉	79
ガラスフリット	2.5
有機ビヒクル	7.5
五酸化リン	0.1
溶剤	10.895
塩化イリジウム	0.005

[0025] Subsequently, the silver electrode of a table and a rear face was formed by calcinating the silver paste 5 for 2 minutes in a 600-degree oxidizing atmosphere after printing / desiccation in the shape of a pattern to a light-receiving side side. This cel was immersed for 1 minute under ordinary temperature into the flux of a presentation of the table 2 which does not contain a halogenide, after hot air drying for 100 degrees, it was immersed in the solder bath of Sn:Pb=6:4 containing 2% silver kept at 200 degrees C for 2 minutes, and the solder layer 7 was formed. This was dried after the rinse for 1 minute with the pure water of ordinary temperature, and the solar battery was completed. In addition, the alcohol of a table 2 is specifically isopropyl alcohol.

[0026]

[A table 2]

成 分	比率 (wt%)
ポリアルキレングリコール系樹脂	49.9
アルコール	49.9
アミン系安定剤	0.2

[0027] With the solder wettability at the time of solder coating in this case, visual inspection after a humidity test (85 degrees C, 85%RH, 500h) was conducted as simple reliability evaluation. It turns out that this humidity test carries out the cel which finished solder coating to the cel which carried out washing desiccation by the above-mentioned method, corrosion powder is generated and a defect can be easily distinguished or solder silver discolors if washing of staining substances, such as a halogen, is inadequate.

[0028] A comparison result with a conventional method is shown in a table 3. The commercial item (8050 made from DuPont S) was used for the silver paste of a conventional method. The number of trials is 25.

[0029]

[A table 3]

	銀ペーストの組成	はんだ濡れ性の不良品数	耐湿性試験の不要品数
本発明	表 1	0/25	0/25
従来法	市販品	25/25	0/25

*フラックス：いずれも活性剤を含まない本発明品を使用

[0030] With the conventional silver paste, since the flux of **** which does not contain a halogenide was used, to having become poor total solder, by the silver paste of this invention, it is a total excellent article

and soldering became possible from the result. In addition, since reliability is using the flux of this invention, it serves as a total excellent article. According to this invention, it is only changing a material, and in any way, there is no complexity and it can apply all the conventional processes as they are.

[0031] [Example 2] In the example 1, although the material comparison of a silver paste was performed using the flux of this invention, flux was compared here. The flux of a conventional method contains the halogenated compound (bromine system) with the commercial item (product made from the SANWA chemical industry SF-60). Cel-izing and the evaluation method are the same as an example 1. The result was shown in a table 4.

[0032]

[A table 4]

	フラックスの組成	はんだ濡れ性の不要品数	耐湿性試験の不良品数
本発明	表 2	0/25	0/25
従来法	市販品	0/25	24/25

* 銀ペースト：いずれも本発明品を使用

[0033] It was [in / at the flux which contains the conventional halogenide from a result / reliability] almost poor, and was a total excellent article in this invention. Also in the flux which removed the antioxidant of the amine system compound added for the long term stability of resin, the same result was obtained from the flux of this invention.

[0034] [Example 3] In the example 2, although the flux material comparison to the silver paste of this invention was performed, the flux material comparison to the conventional silver paste was performed here. The silver paste used the same thing as an example 1. Cel-izing and the evaluation method are the same as an example 1. The result was shown in a table 5.

[0035]

[A table 5]

	フラックスの組成	はんだ濡れ性の不要品数	耐湿性試験の不良品数
本発明	表 2	25/25	0/25
従来法	市販品	0/25	25/25

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[0036] In flux, solder coating had conventionally poor total in the reliability of the possible thing containing that solder coating cannot be performed from a result in the flux which does not contain a halogenide to the conventional silver paste, and an activator. That is, it turns out that it is realizable with the silver paste of this invention, and the combination of flux.

[0037] [Example 4] When compared by changing the presentation comparison in the silver dust end of a silver paste, at 70 - 85wt%, it turned out that it is so much satisfactory. Especially, when it was 78 - 82wt%, there was no generating of a defect. Moreover, when were compared by changing the average molecular weight of the resin contained in flux, and it was 200-800, it turned out that it is satisfactory.

[0038]

[Effect of the Invention] As mentioned above, it became possible, solder coating maintaining a good cel property for the first time using the flux which does not contain the halogenide as an activator by this invention, as explained, and manufacture of a reliable cel was attained. Furthermore, the changed part of this invention with a process is only modification of a silver paste material and a flux material conventionally, and in any way, there is no complexity and it can apply all the conventional processes as they are.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is the abbreviation cross section of the solar battery obtained by the manufacture method of the solar battery of this invention.

[Drawing 2] It is outline manufacture process drawing showing the manufacture method of the solar battery of this invention.

[Drawing 3] It is a conceptual diagram about the component action before and behind baking of the silver paste of this invention, and (a) is a component action before baking of a silver paste, and, similarly (b) is it after baking.

[Description of Notations]

- 1 P Type Silicon Substrate
- 2 N Type Diffusion Layer
- 3 Antireflection Film
- 4 Aluminum Paste (Electrode)
- 5 Six Silver paste (electrode)
- 7 Solder Layer
- 10 Printed Silver Paste
- 11 Calcinated Silver Paste
- 12 Silver Component
- 13 Glass Component

[Translation done.]